



## INVISITRACK LOCATION SOLUTION

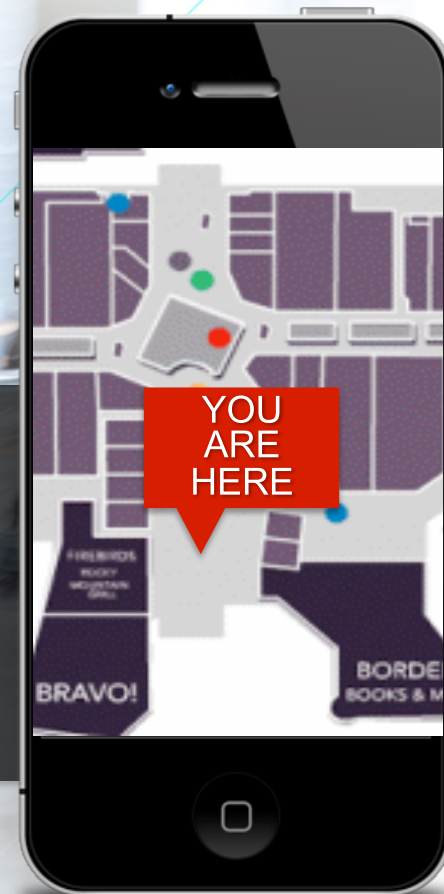
**Russ Markhovsky**

**Invisitrack Inc**

*Founder & President*

[rmark@invisitrack.com](mailto:rmark@invisitrack.com)

(410) 991-8529



## INDOORS FACTS AND FIGURES

**According to Strategy Analytics**, 70% of cellular calls and 80% of data connections originate from indoors: office buildings, shopping malls, airports, hospitals, or sports arenas.

**86% of advertisers** would be willing to pay extra for location based advertising

Revenue for mobile location-based services to reach **\$13 billion by 2014**

**- Juniper Research**

## LTE SIGNAL IS BEST FOR LOCATION POSTIONING

- LTE is OFDM loaded reference signals..
  - (makes much better location beacons than Wi-Fi, GPS, UWB & BT)
- LTE is very stable
  - (higher stability results in lower timing error, better accurate position)
- Typically available at lower frequencies than Wi-Fi, GPS UWB & BT
  - (better penetration and range in harsh environments and indoors)

## INVISITRACK LOCATION SOLUTION (ILS)

- **ILS is best solution to resolve multipath using LTE**
  - Multipath is caused by RF signals bouncing off walls and other obstructions yielding multiple "right answers"
  - Indoors, ***multipath*** is the biggest source of error for precision location.
  - Have shown sub10m indoor accuracy using only macro network; accuracy can improve by x2 with low-cost addition of a few small cells
- **ILS gives greater visibility of nearby LTE signals**
  - Able to see surrounding LTE signals up to twice the distance for InvisiTrack location solution than for voice/data due to signal processing gain in s/w
- **End Result – ILS** *offers best combination of accuracy, range and reliability for a location platform, with minimal power consumption – no GPS, Wi-Fi nor Bluetooth.*



# INVISITRACK COMPANY SNAPSHOT

## ▪ **Founded Sept 2006**

- Incorporated in the State of Delaware
- Headquartered in Annapolis, MD
- First M2M module available in Q2 of 2013

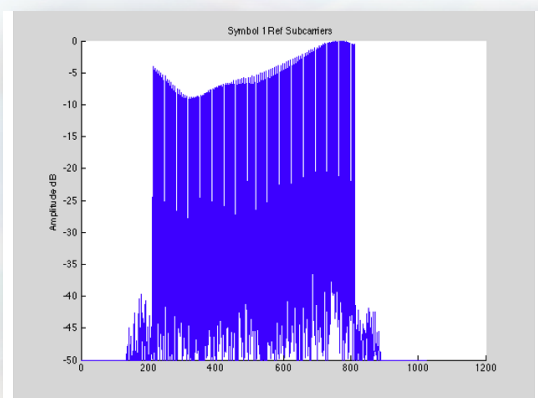
## ▪ **Strong IP Position**

- *Eight issued US patents; others pending plus continuations*
  - ✓ 8,305,215 7,969,311, 7,872,583, 7,822,424; 7,787,886; 7,760,132; 7,561,048; 7,423,580
  - ✓ Covers multipath mitigation, narrow bandwidth ranging, virtual triangulation
  - ✓ Many are OFDM and LTE specific
- Multiple filings in EU, Japan, Korea and China

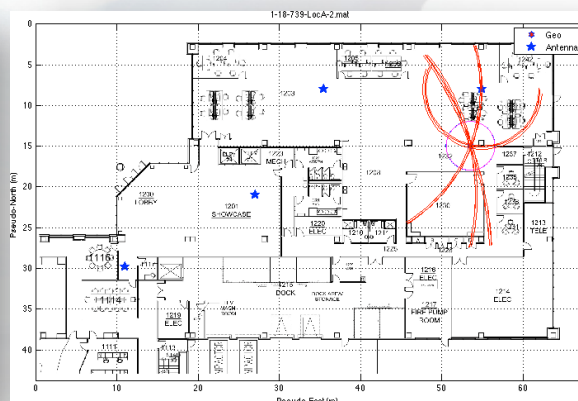
## ▪ **Leaders in LTE Location Positioning Technology 3GPP based**

- Sub 3 meter accuracy for X,Y, and Z axis
  - ✓ Have proven accuracy and reliability in carrier trials
  - ✓ Have demonstrated in macro and small cell environments

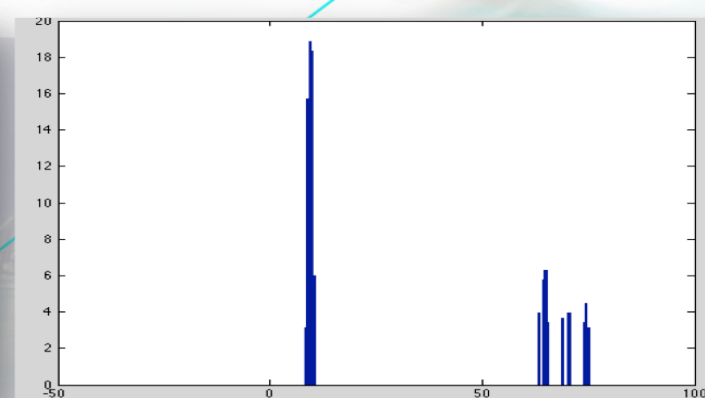
# INVISITRACK ILS ADVANTAGES



LTE Sub-Frame



Results on Map



Post Processed LTE Data

# SIGNAL COVERAGE COMPARISON FOR LOCATION

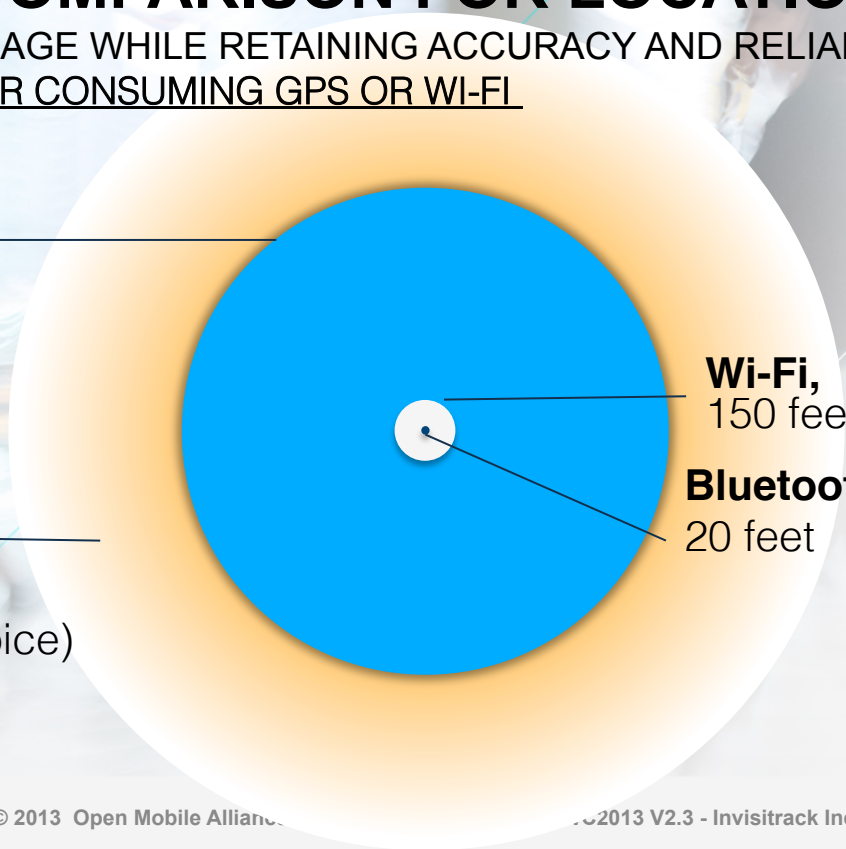
LEVERAGES LTE, BY EXPANDING COVERAGE WHILE RETAINING ACCURACY AND RELIABILITY  
WITHOUT POWER CONSUMING GPS OR WI-FI

**InvisiTrack LTE small cell,**  
1200 feet (2x range of LTE for  
data and voice)

**InvisiTrack LTE macro,**  
5 miles+  
(2x range of LTE for data and voice)

**Wi-Fi,**  
150 feet

**Bluetooth,**  
20 feet



# MANY MACRO TOWERS AND SMALL CELLS VISIBLE INDOORS LOCATIONS

- Example of U.S. LTE Network.
- Location Infrastructure density will increase by at least 2X with LTE growth.
- Further increases with small cell deployment.

**SJC Airport  
2<sup>nd</sup> Floor**

Cell ID	Port
31	0
31	1
32	0
32	1
102	0
102	1
266	0
285	0
288	0
288	1
321	0
321	1
394	0
394	1
405	0
405	1
407	0
407	1
434	0
434	1

**Palo Alto City Hall  
below ground parking**

Cell ID	Port
21	0
27	0
60	1
66	1
114	0
115	0
115	1
116	0
116	1
120	1
129	0
141	0
150	1
153	0
168	1
180	1
242	0
261	0
264	1
270	1
282	1
300	1
318	1
320	0
320	1
321	0
324	1
348	1
354	1
360	1
387	0
390	1
444	1
453	0
453	1
454	0
454	1
455	0
455	1

**Union Square  
Macy's 5<sup>th</sup> Floor**

Cell ID	Port
16	1
31	0
34	1
85	0
97	0
118	1
128	0
128	1
153	0
187	0
189	0
189	1
190	0
190	1
191	0
191	1
226	1
241	0
334	1
400	1
406	1
450	0
450	1
451	0
451	1
452	0
452	1
457	0



# LOCATION TECHNOLOGY COMPARISON – SMALL CELLS

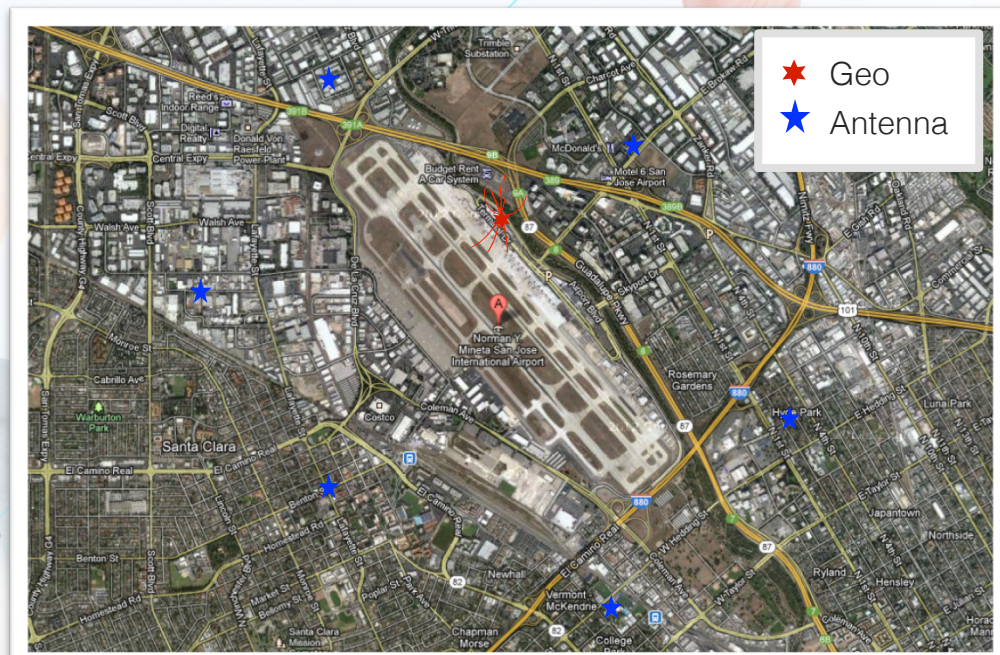
Assumes coverage area of 150,000 sq. ft.

System	Number of AP	Deployment Database generation costs	"Soft" Database expenses (regularly updating/ expanding, etc.)	Total Cost of Ownership	Comments
<b>InvisiTrack</b>	10	N/A	N/A	<b>Low</b> Existing deployments, no further maintenance is necessary	InvisiTrack sub 3m at 67%; no degradation over time. X,Y,Z.
<b>Wi-Fi</b>	160	YES	YES	<b>Very High</b> Significant deployment and maintenance overhead associated with database	Wi-Fi AP Density is defined <b>not</b> by the AP communication range, but by the required accuracy/ reliability over time
<b>UWB</b>	80	NO	NO	<b>High</b> Location references need to be connected by cable; Does not work well outdoors	AP references require unobstructed line-of-sight

# INDOOR LOCATION MACRO NETWORK AT SAN JOSE AIRPORT

**High accuracy  
indoors.**

**Works with  
all LTE  
networks,  
Macro and  
Small cells.**



# ADDRESSES MULTIPLE MARKET SEGMENTS

**Presented as an API call... easily used by multiple market verticals**



## **M2M**

(Location, security,  
asset tracking )



## **PUBLIC SAFETY**

(NG911, first responder)



## **CONSUMER**

(Advertising, couponing,  
rewards, social media)



## **ANALYTICS**

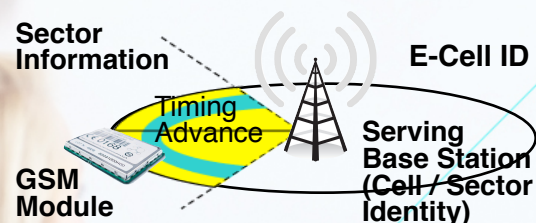
(Marketing, efficiency  
algorithms)



## INVISITRACK API STRATEGY



- Accuracy 1 to 10 Meters
- Latency <1 seconds
- To identify location uses LTE emitters: towers, small cells, DAS, etc.
- Only 2 or 3 emitters are needed for the location fix.
- **In-building accuracy is exceptional**



- Accuracy 300 to 5,000M+
- Latency <3 seconds
- Users multiple towers to identify location
- Greater accuracy outdoors in urban areas where there is greater tower density
- **In-building limited to non-existent**



- Accuracy 5 to 50M
- Latency 10 to 30 second
- Uses of line of sight to identify location
- Greater accuracy outdoors in rural areas
- **In-building very limited to non-existent**

## MOBILE ADVERTISEMENT RECENT FACTS:

(REFERENCE IN NOTES)

**51%**

of the On---The---Go Audience is willing to share their current location to receive more relevant advertising.

**63%**

of consumers feel a reward or coupon is the most valuable form of mobile marketing (paper coupons Redemption with: 1%)

LBS revenue will increase to **\$8.3 billion** by 2014. Search and maps will deliver the highest revenue.

**2X**

Brands are planning to double their spent on Location Based Marketing, Rewards & Advertising in the next 2 years

**86%**

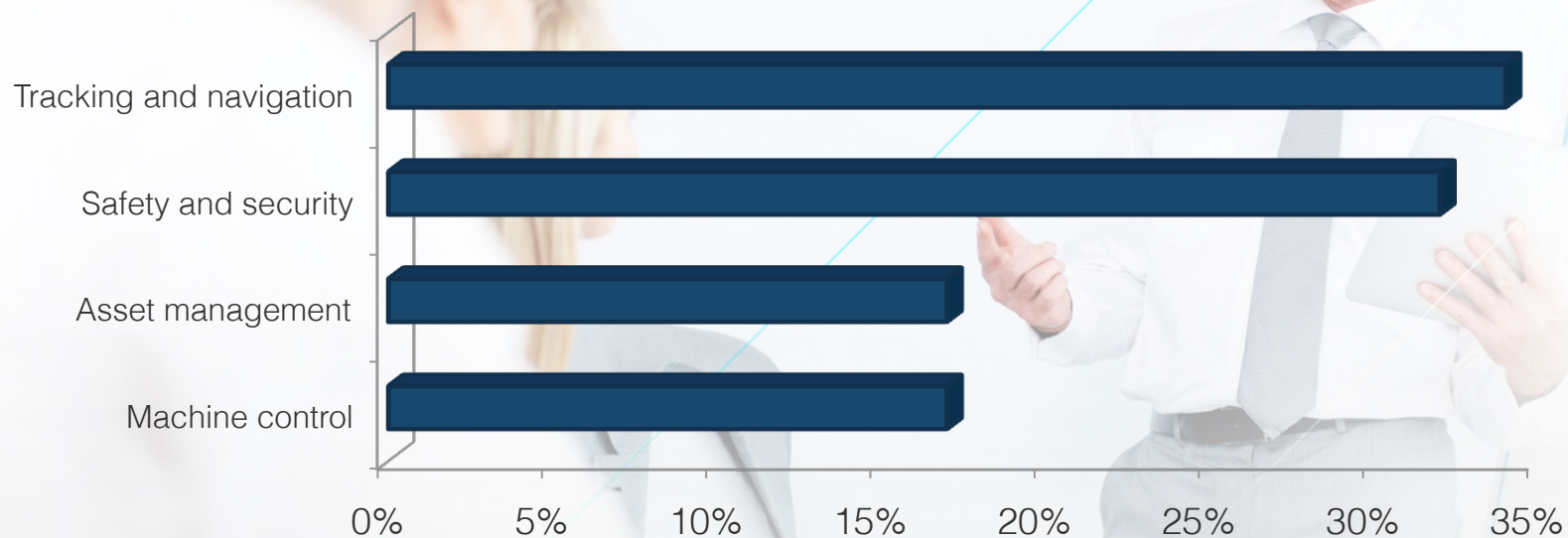
of advertisers would be willing to pay extra for LBA due to higher ROI



# BILLIONS OF CONNECTED DEVICES IN 2020

***“Frost & Sullivan believes that eventually, both direct connections and revenues from M2M could become larger than traditional mobile phone business in several regions of the world, including North America”– Frost & Sullivan***

## MOST LIKELY USES FOR M2M (LOCATION PLAYS A BIG ROLE)



*Source: Strategy Analytics, AV&Co analysis*

# SUMMARY-INVISITRACK ILS -ADVANTAGES

## Performance Advantages

- Results in hybrid wide-area and local-area location solution
  - Unmatched sub-3 meter indoor accuracy across (x,y,z) axes
  - Range
  - Reliability
  - Fast location fix (1 second latency)
  - Lowest power consumption – no additional GPS, Wi-Fi hardware or modes needed with ILS
- Low-cost, easy deployment
  - In-band LTE solution - no additional radios for operation as GPS, Wi-Fi, Bluetooth



# THANK YOU

**RUSS MARKHOVSKY**

INVISITRACK INC  
Founder & President  
[rmark@invisitrack.com](mailto:rmark@invisitrack.com)  
(410) 991-8529